

*Delaware.*—Delaware Breakwater, 15th, 22d.  
*Florida.*—Archer, 5th, 6th; Tallahassee, 5th, 14th, 22d; Jacksonville, 22d; Pensacola, 21st, 22d; Sanford, 23d.  
*Georgia.*—Athens, 14th; Atlanta, Milledgeville and Savannah, 22d; Augusta and Forsyth, 21st, 22d.  
*Illinois.*—Swanwick, 27th.  
*Indiana.*—Laconia, 28th; Greencastle, 30th.  
*Kansas.*—Emporia, Independence, Wellington, and Yates Centre, 4th.  
*Louisiana.*—Grand Coteau, 4th, 5th, 11th, 17th, 28th; New Orleans, 11th, 17th; Point Pleasant, 20th, 21st; Liberty Hill, 27th to 30th; Shreveport, 29th, 30th.  
*Maine.*—Eastport, 15th; three flashes of lightning were observed at 5.30 a. m.  
*Maryland.*—Baltimore, 31st.  
*Massachusetts.*—Fall River and Taunton, 23d.  
*Michigan.*—Hillsdale, 21st.  
*Mississippi.*—Vicksburg, 14th, 21st.  
*Missouri.*—Pierce City, 4th, 5th; Springfield, 29th.  
*Nebraska.*—Genoa, 4th.  
*New Jersey.*—Moorestown, 15th; Vineland, Cape May, Little Egg Harbor, Barnegat City, and Atlantic City, 22d.  
*North Carolina.*—Kitty Hawk, 12th, 15th, 22d; Hatteras, 14th, 21st; Kelly's (near Raleigh), 15th; Smithville, 15th, 21st, 22d; Fort Macon, 21st; New River Inlet and Wilmington, 21st, 22d; Weldon, 22d; Charlotte, 28th.  
*Pennsylvania.*—Pittsburg, 6th.  
*Rhode Island.*—Narragansett Pier, 22d; heavy thunder-storm from 4.30 to 4.40 a. m.  
*South Carolina.*—Pacolett, 14th, 22d; Aiken and Stateburg, 22d.  
*Tennessee.*—Chattanooga, 21st; Knoxville, 22d; Memphis and Milan, 28th, 30th.  
*Texas.*—Clarksville, 4th, 26th; Galveston, 4th, 5th, 27th, 28th, 29th; Palestine, 4th, 10th, 11th, 26th, 28th, 29th, 30th; Fort Davis, 10th; Fort Concho, 10th, 11th, 30th; Indianola, 10th, 22d, 28th; Cleburne, 11th, 12th, 27th, 28th; Brownsville, 31st.  
*Virginia.*—Dale Enterprise, 6th; Wytheville, 6th, 15th; Cape Henry, Chincoteague, and Fort Myer, 15th.  
*Washington Territory.*—Port Angeles, 5th.  
*West Virginia.*—Helvetia, 6th.

## ELECTRICAL PHENOMENA.

The observer on the summit of Mount Washington, New Hampshire, reports the following:

"During the 19th everything on the summit was highly charged with electricity. A brass tube held against the stove discharged perceptible sparks; by touching the ears of the cat electric sparks were emitted, producing a snapping noise resembling that caused by lighting a match."

## OPTICAL PHENOMENA.

## SOLAR HALOS.

Solar halos were observed in the various states and territories as follows:

*Arkansas.*—1st, 7th, 8th, 24th, 26th, 31st.  
*California.*—14th, 15th.  
*Connecticut.*—23d, 24th.  
*Dakota.*—10th, 19th, 21st, 22d, 26th, 30th, 31st.  
*Delaware.*—5th.  
*Florida.*—1st, 4th, 6th, 8th, 12th, 16th.  
*Idaho.*—10th, 11th, 31st.  
*Illinois.*—22d.  
*Iowa.*—4th, 8th, 9th, 16th, 18th, 22d, 24th, 31st.  
*Kansas.*—1st, 8th, 24th, 30th, 31st.  
*Louisiana.*—24th.  
*Michigan.*—19th, 21st, 23d, 24th.  
*Minnesota.*—15th, 22d, 24th, 31st.  
*Missouri.*—31st.  
*Nebraska.*—22d, 24th, 31st.  
*New York.*—1st, 17th, 25th, 27th, 29th, 30th.

*North Carolina.*—12th, 14th, 22d, 23d.  
*Ohio.*—1st.  
*Tennessee.*—23d, 24th.  
*Texas.*—12th, 15th, 30th, 31st.  
*Utah.*—7th.  
*Virginia.*—5th, 8th, 16th, 23d, 25th, 28th, 29th.  
*Wisconsin.*—22d, 24th.

## LUNAR HALOS.

Lunar halos were observed in the various states and territories as follows:

*Arizona.*—7th, 24th, 25th.  
*Arkansas.*—24th.  
*California.*—24th, 25th, 29th, 30th.  
*Colorado.*—2d.  
*Connecticut.*—4th, 23d, 29th.  
*Dakota.*—24th, 26th, 29th, 31st.  
*Delaware.*—1st, 22d, 23d, 25th, 29th, 30th, 31st.  
*District of Columbia.*—29th, 31st.  
*Florida.*—2d, 3d, 7th, 25th, 30th.  
*Georgia.*—1st, 4th, 5th, 31st.  
*Idaho.*—1st, 31st.  
*Illinois.*—3d, 8th, 25th.  
*Indiana.*—4th, 5th, 28th.  
*Indian Territory.*—24th, 26th, 28th to 31st.  
*Iowa.*—4th, 5th, 9th, 24th, 31st.  
*Kansas.*—1st, 3d, 10th, 23d to 26th, 30th.  
*Kentucky.*—27th to 30th.  
*Louisiana.*—25th, 29th, 30th.  
*Maine.*—29th.  
*Maryland.*—30th.  
*Massachusetts.*—23d, 25th, 29th.  
*Michigan.*—3d, 4th, 24th, 25th, 26th.  
*Minnesota.*—4th, 23d, 25th, 26th, 29th, 30th.  
*Missouri.*—9th, 31st.  
*Montana.*—29th.  
*Nebraska.*—3d, 4th, 5th, 8th, 10th, 30th.  
*Nevada.*—1st, 30th.  
*New Hampshire.*—25th, 29th.  
*New Jersey.*—4th, 5th, 23d.  
*New Mexico.*—3d.  
*New York.*—1st, 4th, 6th, 23d, 25th, 27th to 31st.  
*North Carolina.*—4th, 22d, 26th, 27th, 28th.  
*Ohio.*—5th, 6th, 22d, 24th, 26th, 28th, 29th, 30th.  
*Oregon.*—30th.  
*Pennsylvania.*—23d, 27th, 30th, 31st.  
*Rhode Island.*—23d, 29th.  
*Tennessee.*—1st, 2d, 9th, 10th, 24th, 26th, 28th to 31st.  
*Texas.*—1st, 2d, 7th, 12th, 24th, 25th, 26th, 28th, 30th.  
*Utah.*—6th, 24th, 28th, 31st.  
*Vermont.*—25th.  
*Virginia.*—1st, 4th, 5th, 7th, 8th, 9th, 24th, 27th to 31st.  
*Washington Territory.*—8th, 28th, 30th.  
*Wisconsin.*—3d, 4th, 22d, 24th, 26th, 29th, 31st.  
*Wyoming.*—6th, 25th, 26th.

The phases of the moon during December were: full moon, 2d, 1.53 p. m.; last quarter, 9th, 6.24 a. m.; new moon, 17th, 8.18 a. m.; first quarter, 25th, 8.15 a. m.; perigee, 2d, 10 p. m.; apogee, 16th, 11 p. m.

## MIRAGE.

Delaware Breakwater, Delaware, 24th: Cape May was plainly visible all day, and appeared to be only a few miles distant. The images of vessels appeared doubly reflected, the first image being inverted and the second above the first in an upright position; all the images appeared much flattened and elongated; the horizon appeared much elevated and vessels at great distances were seen, all appearing with distinctness. An unusually high temperature for the season and a hazy atmosphere prevailed all day.

Fort Grant, Arizona, 3d: a beautiful mirage was observed this a. m. in the south. The shapes of the mountains were

distorted into a variety of forms, and a reflection of a cataract was visible for one hour.

Mirages were observed at other places as follows:

Webster, Dakota, 25th.

Salina, Kansas, 2d.

Genoa, Nebraska, 2d, 8th.

### MISCELLANEOUS PHENOMENA.

#### SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,943 observations to have been made, of which four were reported doubtful; of the remainder, 4,939, there were 4,193, or 84.9 per cent., followed by the expected weather.

#### SUN SPOTS.

Professor David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for December, 1884:

Date— Dec., 1884.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr's	Spots	Gr's	Spots	Gr's	Spots	Gr's	Spots	
1, 10 a. m.	1	15†	0	0	1	1	4	40†	
2, 10 a. m.	0	0	0	0	0	0	4	40†	
3, 3 p. m.	0	0	1	5†	0	0	3	35†	
4, 9 a. m.	0	0	0	0	0	0	3	35†	
5, 1 p. m.	1	5†	0	0	1	1	4	40†	
7, 10 a. m.	0	0	0	5†	0	0	4	25†	
14, 11 a. m.	0	0	0	0	0	0	4	10†	
14, 2 p. m.	0	0	0	0	0	0	4	10†	
16, 10 a. m.	2	5†	0	0	1	1	6	15†	Spots mostly small.
19, 10 a. m.	1	20†	0	0	1	10†	4	25†	
20, 3 p. m.	1	20†	0	0	1	10†	5	45†	
23, 8 a. m.	1	3	0	0	1	3	6	30†	
25, 11 a. m.	0	0	2	5†	0	0	3	35†	
26, 4 p. m.	0	0	0	0	0	0	3	25†	
29, 4 p. m.	0	0	0	0	0	0	3	15†	
30, 4 p. m.	2	5†	0	0	0	0	5	20†	

Facula were seen at the time of every observation. †Approximated.

#### SUN GLOWS.

The sun glows continued during December, and were as extensively reported as in previous months.

The observer on the summit of Mount Washington, New Hampshire, reports the following: "At sunset on the evening of the 19th the western sky was beautifully tinged with a red-dish purple color; the setting of the sun in a bank of cloud which was below the elevation of the summit made a rare and beautiful sight."

The observer at Point Judith, Rhode Island, reports that the sunset display on the 30th was the most brilliant observed since the autumn of 1883.

Many observers along the Atlantic coast report the display on the 6th as exceptionally brilliant.

#### EARTHQUAKES.

The following is from the "New York Maritime Register" of January 14, 1885:

The British bark "Helen Isabel," Olsen, from Cadiz, which arrived at Saint John's, Newfoundland, January 8, reported that on December 18, at 2 a. m., latitude 38° 51' N., longitude 29° 55' W., experienced terrific earthquake shocks lasting fifteen minutes. The ship was shaken in every fibre, and the crew, paralyzed with fear, broke through all discipline and cut the boats loose. The cessation of the shocks restored tranquility on board. The sea was calm and the weather fine at the time.

The British ship "Struan," which arrived at San Francisco January 2, from Panama, reports December 6, 11.30 p. m., latitude 4° 17' N., longitude 100° —, experienced two distinct shocks of earthquake, the first lasting about thirty seconds, with an interval of twenty seconds, the other lasting about fifteen seconds, both of which shook the ship as though she were passing over a reef. The sea at the time was very smooth, with light breeze from sw.

The San Francisco "Evening Bulletin" of December 13, 1884, contains the following:

An examination of the tidal sheet from the self-registering tide-gauge of the United States Coast Survey at station Saucelito, clearly shows the record of a series of earthquake waves that entered the Golden Gate on the

12th of last November. They commenced at eight o'clock in the morning and ended at eleven. There are nine well marked crests in two and one-half hours, or only seventeen minutes apart. They are only two or three inches in height, but maintain the characteristic earthquake features in plain contrast with the breaking bar markings which are very sharp and frequent. It would appear from the height and length of the waves and its short variations that this submarine earthquake took place near our coast and was not violent.

LACONIA, N. H., December 17, 1884.—The heaviest earthquake shock ever experienced here occurred at about two o'clock this morning. It was felt in all the adjoining towns, but the heaviest jar was at Centre Harbor, lasting half a minute. The vibrations seemed to come from a northerly direction and to pass toward the south. Doors and dishes were shaken in many residences in this town.

The following is from the "New York Herald" of December 27, 1884:

MADRID, December 26, 1884.—An earthquake occurred here to-day. Two houses were slightly damaged. Some alarm was caused by the shock at the opera house and in the populous quarters of the city. The shocks were felt at Gibraltar, and were severe in the southern provinces. They caused great alarm among the people at Granada. At Malaga two persons were killed by falling walls.

Numerous towns are reported as having suffered from the earthquake. Several houses, including the telegraph station, at Velez Malaga were badly injured, and the terrified inhabitants encamped in the outskirts of the town during the night. Many persons were injured at Loja, Motril, and Alhama, and the convent at Seville was partly destroyed. The people were greatly alarmed.

An official in the Velez telegraph office was killed. It is reported that several other people were killed there. One person was killed and many were injured at Motril. The village of Albuñuelas, in Granada, was nearly destroyed. Slight damage was done in cities of Seville and Granada.

The "New York Journal of Commerce" for December 30, 1884, contains the following:

MADRID, December 29.—According to the official news of the earthquake up to last midnight five hundred and twenty-six persons were killed in the Province of Granada and one hundred in Malaga. At Alhama over three hundred and fifty bodies have already been recovered. At Periana, a village in Andalusia, about thirty miles from Malaga, great damage was done, and many lives were lost. Sixty bodies have so far been recovered. Many persons died of fright.

A fatal land slip occurred in the mountains near Periana. This destroyed many houses which stood in its path and buried forty-eight persons. Of these eighteen were rescued alive.

It is reported that nine hundred persons were buried beneath the ruins of the buildings of Albuñuelas. Three churches at Antiquera were left in a tottering condition. The inhabitants are encamped in the fields.

The telegraph lines in Andalusia were rendered useless in consequence of the earthquake. Advices received by mail show that the results in Malaga were even more terrible than heretofore reported. The loss in the town exceeds \$500,000. Two hundred and twenty-seven houses were damaged.

Renewed shocks were felt in various places to-day. Further damage was done at Cordova, and the inhabitants are leaving the town in a panic.

VIENNA, AUSTRIA, December 28.—A severe earthquake shock was experienced in Carinthia to-day. Considerable damage was done to many buildings.

LONDON, December 29.—An earthquake was felt in Wales to-day. Many houses were injured.

The following is from the "Philadelphia Public Ledger" of January 1, 1885:

MADRID, December 31.—Further earthquake shocks were experienced yesterday at Velez Malaga, a city of 13,000 people, a few miles from Malaga. They were very violent, and many houses that had been previously damaged were utterly destroyed. The people were terror-stricken and have abandoned the city altogether. They are now encamped outside the town, and the telegraph station has been removed to the same place.

The shocks yesterday were also felt with more or less severity elsewhere throughout the province of Malaga and through Granada. They occurred between 7 and 10 a. m. There was further loss of life and property at Periana, Riogordo, Vinuela, and Alfanatejo.

A thousand houses at Alhama are in ruins. The work of searching the debris for the bodies of the victims was vigorously prosecuted yesterday, and one hundred and ninety-two bodies were recovered.

It is estimated that the total number of persons who have been killed since Christmas is 2,000. The town of Albuñuelos was completely destroyed. Many persons perished, among whom were several local officials.

Subscriptions for the relief of the sufferers have been started at Madrid, Malaga, and Granada. The king has subscribed \$6,000.

The panic caused by the recent earthquakes is increasing at Archidona, Granada, Torrex, and Velez Malaga. The inhabitants are still encamped